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DOI: <https://doi.org/10.3897/alpento.4.49492>

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ZORA URL: <https://doi.org/10.5167/uzh-199565>

Journal Article

Published Version



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Originally published at:

Bächli, Gerhard; Vilela, Carlos R (2020). On the identity of *Paracacoxenus kaszabi* Okada, with the formal description of a new closely related species (Diptera, Drosophilidae). *Alpine Entomology*, 4:1-20.

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On the identity of *Paracacoxenus kaszabi* Okada, with the formal description of a new closely related species (Diptera, Drosophilidae)

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<http://zoobank.org/57780613-D73C-423B-A3E0-C316DF1B7478>

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Academic editor: Patrick Rohner ♦ Received 17 December 2019 ♦ Accepted 15 January 2020 ♦ Published 6 March 2020

Abstract

In order to clarify the identity of *Paracacoxenus kaszabi* Okada, 1973, a species described from Mongolia, the morphological structures of one male paratype, collected at 1,750 m altitude, were analyzed and redescribed. In addition, one of the male specimens, previously referred to in literature as ‘sp. aff. *kaszabi*’, is restudied and described as *Paracacoxenus macai* sp. nov. (type locality: Schmelz, Parco Nazionale dello Stelvio, Province of Bolzano, Region of Trentino-Alto Adige, Italy). The former species seems to be distributed in central and eastern Asia while the latter is supposed to have an exclusively European distribution. The midtibial preapical seta of male *Paracacoxenus argyreator* (Frey, 1932), which is unusually long, is illustrated by photomicrographs. A key to the European species of *Paracacoxenus* Hardy, 1960 is presented.

Key Words

Taxonomy, Switzerland, Siberia, Czech Republic, key

Introduction

Paracacoxenus kaszabi was described from Mongolia by Okada (1973). Further detailed records were published from the Czech Republic (Máca 1980, Máca and Laštovka 1986, Máca and Barták 2001) as well as from Siberia (Watabe et al. 1995, Vinokurova 2003).

In a former paper (Bächli and Vilela 2011), we provided a description of a species from northern Italy, provisionally named as ‘*Paracacoxenus* sp. aff. *kaszabi* sp. nov.’, because some doubts existed as to whether this species was really different from *P. kaszabi*, of which only the rather short description by Okada (1973) was known. This was later complemented by some additional characters added by Máca (1980).

Máca (1980), while discussing one male and three female *Paracacoxenus* specimens found in Veselí nad Lužnicí (South Bohemia, Czech Republic), provided some illustra-

tions and additional characters, primarily to distinguish it from *P. exiguus*, a species originally found in Silesia (Poland). He mentioned that the specimen at hand showed minor differences from Okada’s description and figures, but his decision to identify them as *P. kaszabi* was sound because *P. kaszabi* was then the only species which had been described.

Through the assistance of Dr Jan Máca, we were able to analyse three European male specimens from his collection, formerly identified by him as *P. kaszabi*. Because both species are morphologically very similar, we had some hope that at least the male terminalia would demonstrate clear differential characters.

The general morphology and the male terminalia of ‘*Paracacoxenus* sp. aff. *kaszabi* sp. nov.’ have already been published (Bächli and Vilela 2011). In this paper, we want to describe the differences between *P. kaszabi* and ‘*Paracacoxenus* sp. aff. *kaszabi*’, formally described here as *Paracacoxenus macai* sp. nov.

Material and methods

The redescription of *Paracoxenus kaszabi* Okada, 1973 is based on a male paratype specimen on loan from the Hungarian Natural History Museum (HNHM), Budapest (Bächli 1984, Bächli and Rocha Pité 1984). For comparison purposes, three *Paracoxenus* male specimens on loan from our colleague Dr Jan Máca, collected in Veselí nad Lužnicí, Czech Republic, were checked. The following collection abbreviations are used:

- HNHM** Hungarian Natural History Museum, Budapest, Hungary;
MHNG Muséum d'Histoire naturelle, Genève, Switzerland;
PCJM Private collection of Dr. Jan Máca, Veselí nad Lužnicí, Czech Republic;
ZMB Museum für Naturkunde, Leibniz-Institut für Evolutions- und Biodiversitätsforschung, Berlin, Germany [former: Museum für Naturkunde der Humboldt-Universität zu Berlin];
ZMUZ Zoologisches Museum der Universität Zürich, Zürich, Switzerland.

Data labels attached to each type specimen are cited in full with a slash [/] indicating a line change and a double slash [/] a label change. Our own notes or interpretations are included in brackets (also in other items throughout the text).

The preparation of microscope slides were made following Wheeler and Kambyseilis (1966) and Kaneshiro (1969). The abdominal sclerites, including the disarticulated male terminalia, are preserved in microvials filled with glycerin and attached by the stopper to the pin of the respective specimen. Refer to Vilela and Bächli (2000) and Bächli et al. (2004) for further details.

Male pinned specimens and their dissected terminalia were photomicrographed with a Smartphone's back camera (Samsung S8) attached to both a stereomicroscope and to a compound microscope respectively. Several images in different focal planes were obtained for every specimen and they were then digitally stacked using the "All Methods" mode of Combine ZP free software (Hadley 2010) and the final all-in-focus image was improved using the Adobe Photoshop Elements 2.0 software. Male dissected terminalia were also drawn using a camera lucida (1.8x) attachment on a compound microscope under a 20x objective. For measurements and indices see Vilela and Bächli (1990); for morphological terminology see Vilela and Bächli (2000) and Bächli et al. (2004).

Results

Paracoxenus Hardy in Hardy & Wheeler, 1960

Type species. *Paracoxenus guttatus* Hardy and Wheeler, 1960: 358 (original designation). Status and references are given by Bächli and Vilela (2011).

Species included. *Paracoxenus exiguus* (Duda, 1924), *P. argyreator* (Frey, 1932), *P. guttatus* Hardy and Wheeler, 1960, *P. kaszabi* (Okada, 1973), *P. macai* sp. nov.

Paracoxenus kaszabi Okada, 1973

Figs 1–22

Paracoxenus kaszabi Okada: Okada (1973: 271) [description, figures]; Máca (1980: 338) [description, figures, distribution, misidentification, see below]; Sidorenko (2001: 219) [key].

Coxenus kaszabi (Okada): Bächli (1984: 33) [types]; Toda and Vinokurov (1995: 189) [biology, distribution: Siberia]; Watabe et al. (1995: 199) [distribution: Siberia]; Máca and Barták (2001: 431) [distribution, misidentification, see below]; Vinokurova (2003: 100) [distribution: Siberia].

Coxenus (*Paracoxenus*) *kaszabi* (Okada): Tsacas and Desmier de Chenon (1976: 500) [affiliation]; Wheeler (1981: 23) [affiliation]; Bächli and Rocha Pité (1984: 191) [affiliation]; Toda et al. (1996: 466) [key]; Bächli et al. (2004: 52) [key]; Brake and Bächli (2008: 251) [affiliation].

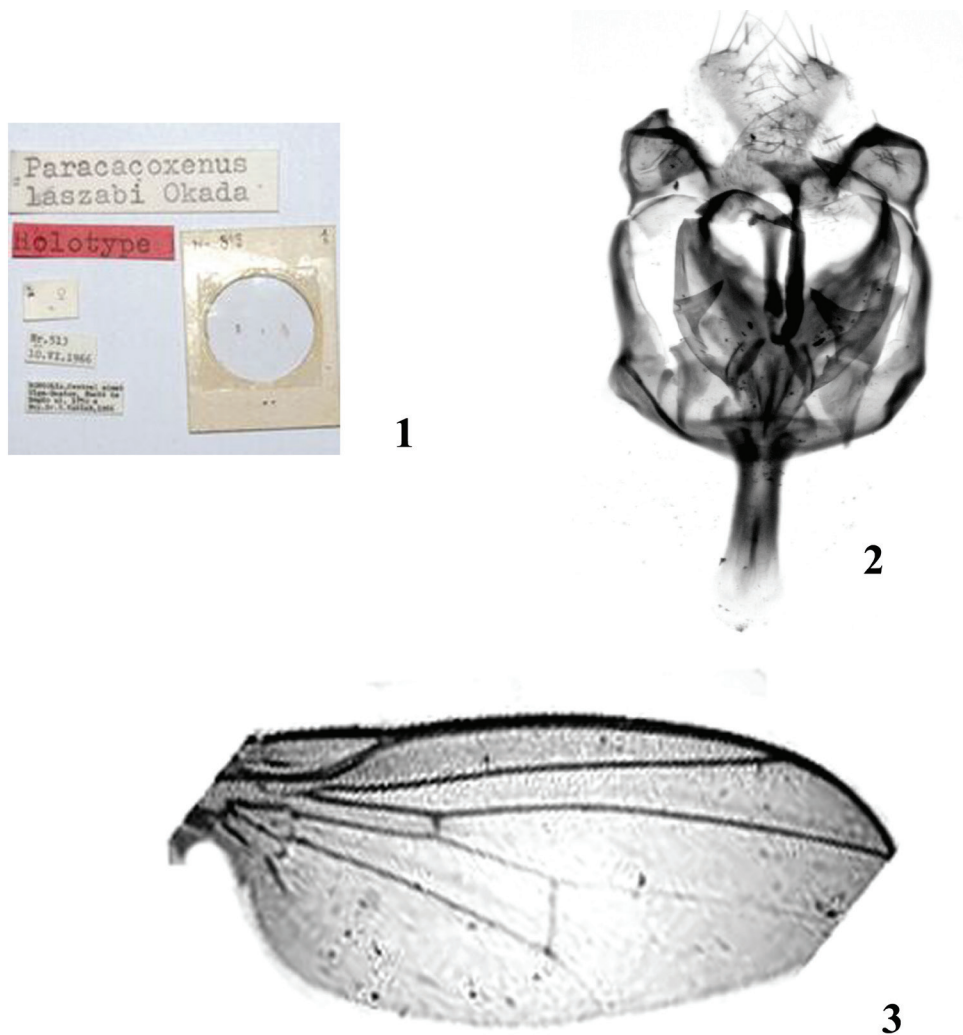
Coxenus (*Gitonides*) *kaszabi* (Okada): Sidorenko (2002: 10) [phylogeny].

Type locality. MONGOLIA: Central aimak, Ulan-Baator, Nucht im Bogdo ul [47°54'N, 106°54'E], 1750m.

Material examined. MONGOLIA: 1 ♂ (Paratype), labelled "Mongolia, Central aimak / Ulan-Baator, Nucht im / Bogdo ul, 1750 m / Exp. Dr. Z. Kaszab, 1966 // Nr. 513 / 10.VI.1966 // ♂ // PARATYPE [white label] // *Paracoxenus* / *kaszabi* Okada / Bächli & Vilela det. 2017" (HNHM). Photomicrographs of holotype slide (HNHM).

Diagnosis. Analysis of some male terminalia sclerites is required to tell this species apart from *Paracoxenus macai* sp. nov. They are as follows: cerci narrow and bearing a longitudinal row of setae adjacent to inner margins (Figs 13, 14), aedeagus ellipsoid-shaped in dorsal and ventral views (Figs 15, 16), inner paraphyses tribranched (Figs 21, 22), and gonopods smooth (Figs 17, 18).

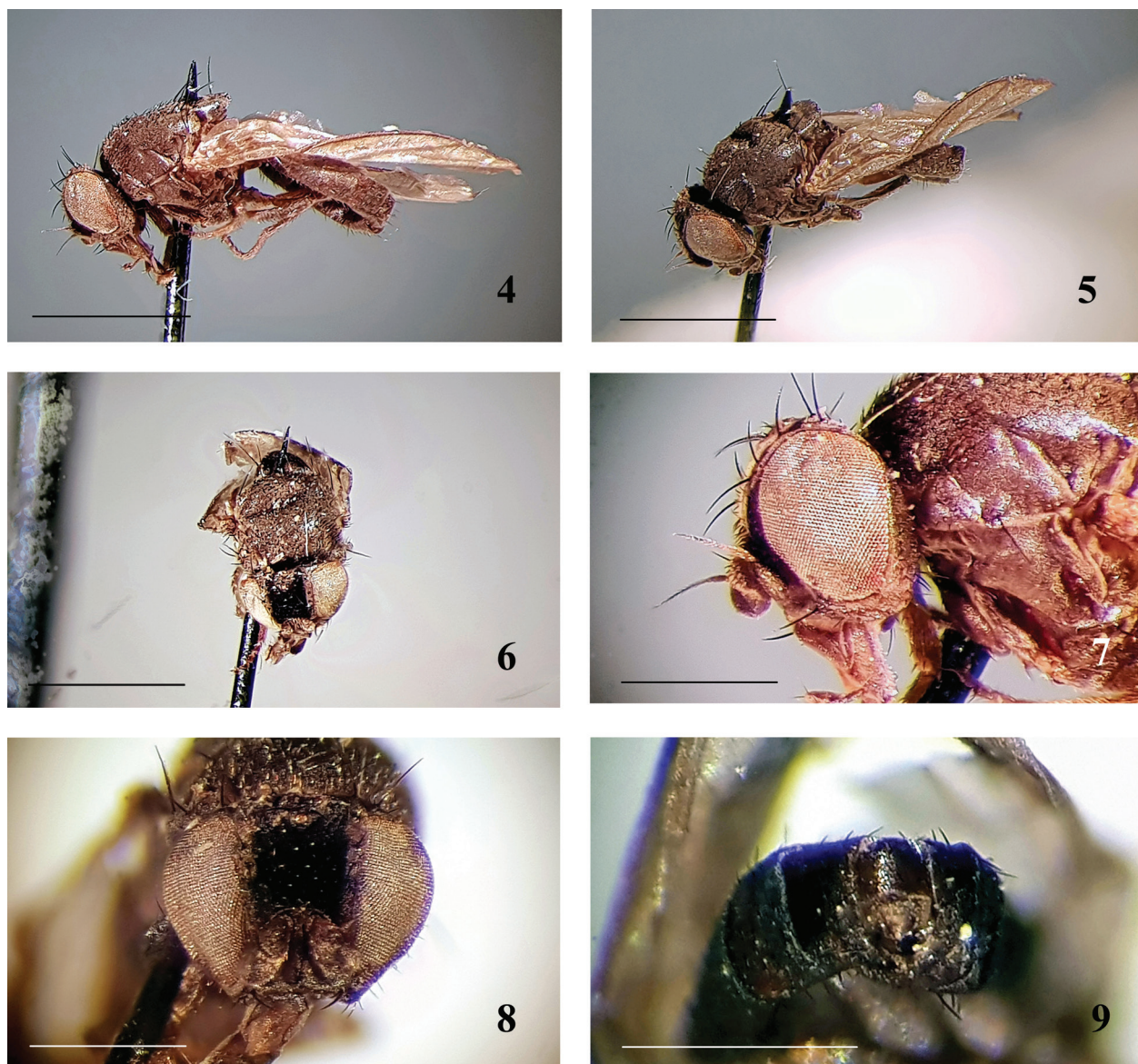
Description. ♂. **Head:** Frons (Figs 6, 8) centrally velvety black; all setae black. Frontal length 0.38 mm; frontal index about 1.00, top to bottom width ratio about 1.19. Frontal triangle not distinguishable; ocellar triangle greyish-black, microtrichose, about 40 % of frontal length. Orbital plates greyish-black, microtrichose, about 80 % of frontal length. Orbital setae arranged almost in a row, distance of or3 to or1 about 157 % of or3 to vtm, or1 / or3 ratio about 1.09, or2 / or1 ratio about 0.83; vt index about 1.00, postocellar setae broken or invisible; ocellar setae about 57 %, of frontal length, vibrissa (Fig. 7) about 50 % of frontal length. Face black. Carina narrow, slightly prominent. Cheek index about 9. Eye index about 1.26. Occiput black. Antenna black. Flagellomere 1 roundish, length to width ratio about 1.00. Arista microtrichose (Fig. 7). Proboscis black. Palpus short, black, with 2 more prominent apical setae. **Thorax** dull black, length about 1.19 mm, 8 rows of acrostichal setae (Figs 4–6), one prominent h. Anterior and posterior dorsocentral setae close together, transverse distance about 6x of longitudinal distance; dc index = 0.38. Scutellar setae nearly equi-



Figures 1–3. *Paracacoxenus kaszabi* Okada, ♂ holotype, Central aimak, Ulan-Baator, Nucht im Bogdo ul, Mongolia (HNHM)
1 Labels (mislabelled as a female) and slide with wing and terminalia **2** Photomicrograph of terminalia, dorsal view **3** Right wing, dorsal view, distally optically cut. Photos: Z. Soltész.

distant; basal ones divergent; apical scut broken. Haltere whitish. Legs black, knees slightly paler. **Wing** hyaline, damaged and partly folded, length 1.40 mm (Fig. 3 from holotype). **Abdomen** dull black (Figs 4, 9). Syntergite 6 + 7 (Fig. 9) without a claw-like extension. **Terminalia** ♂ (Figs 2 [holotype], 9–22): Epandrium microtrichose (Fig. 14), except for the anteroventral region, with no ventral, and 1–2 dorsal setae, ventral lobe fused to surstylus. Cercus narrow [wide in *Paracacoxenus macai* sp. nov.], ventrally positioned, laterally connected to epandrium by membranous tissue, covered with only 8 setae [18–21 in *P. macai* sp. nov.] organized in a longitudinal row (Figs 13, 14) adjacent to inner margin, microtrichose, without ventral lobe. Surstylus without prensisetae, bearing 3 outer setae (Figs 12, 13, 20) [2 in *P. macai* sp. nov.] on central membranous area and no inner seta, not microtrichose, completely fused to ventral lobe of epandrium which is slightly microtrichose in the fusion area (Figs 13, 14). Decasternum divided into two articulate sections connected by a membranous strip, folded over one another (Figs 17,

18); proximal section flattened, anteromedially somewhat projected posterad, medially slightly concave, distally fused to surstyli and laterally connected to hypandrium arms by membranous tissue (Figs 16, 17); distal section [ventral process of Grimaldi (1990): 76, 77 (fig. 424), 78] V-shaped at rest (Figs 17b, 17c, 20), proximally bifid, distally flattened, slightly bifid and expanded laterad, marginally non-crested (Figs 17g, 18d) [widely expanded and marginally crested in *P. macai* sp. nov.] and fused to dorsomedian region of aedeagus. Hypandrium somewhat square-shaped in posterior view (Figs 2 [holotype], 15, 16, 18), as long as epandrium, anterior margin slightly convex and expanded laterad; posterior hypandrium process absent, “dorsal arch” (see Bächli et al. 2004: 14) formed by a complex, two-sectioned decastrum (Figs 17a–c, 20); gonopods fused to each other and to anterior very end of hypandrium, devoid of warts [conspicuously warted in *P. macai* sp. nov.], bearing 0–1 lateral setula (Figs 17, 18, 20). Aedeagus reduced to a membranous dorsoventrally flattened bag (Fig. 17), ellipsoid-shaped



Figures 4–9. *Paracacoxenus kaszabi* Okada, ♂ paratype, Central aimak, Ulan-Baator, Nucht im Bogdo ul, Mongolia (HNHM) 4 Habitus, left lateral view 5 Habitus, oblique dorsal 6 Habitus, dorsal 7 Head close-up, left lateral 8 Head close-up, dorsal 9 Terminalia close-up, posterior. Scale bars: 0.5 mm (7–9); 1.0 mm (4–6).

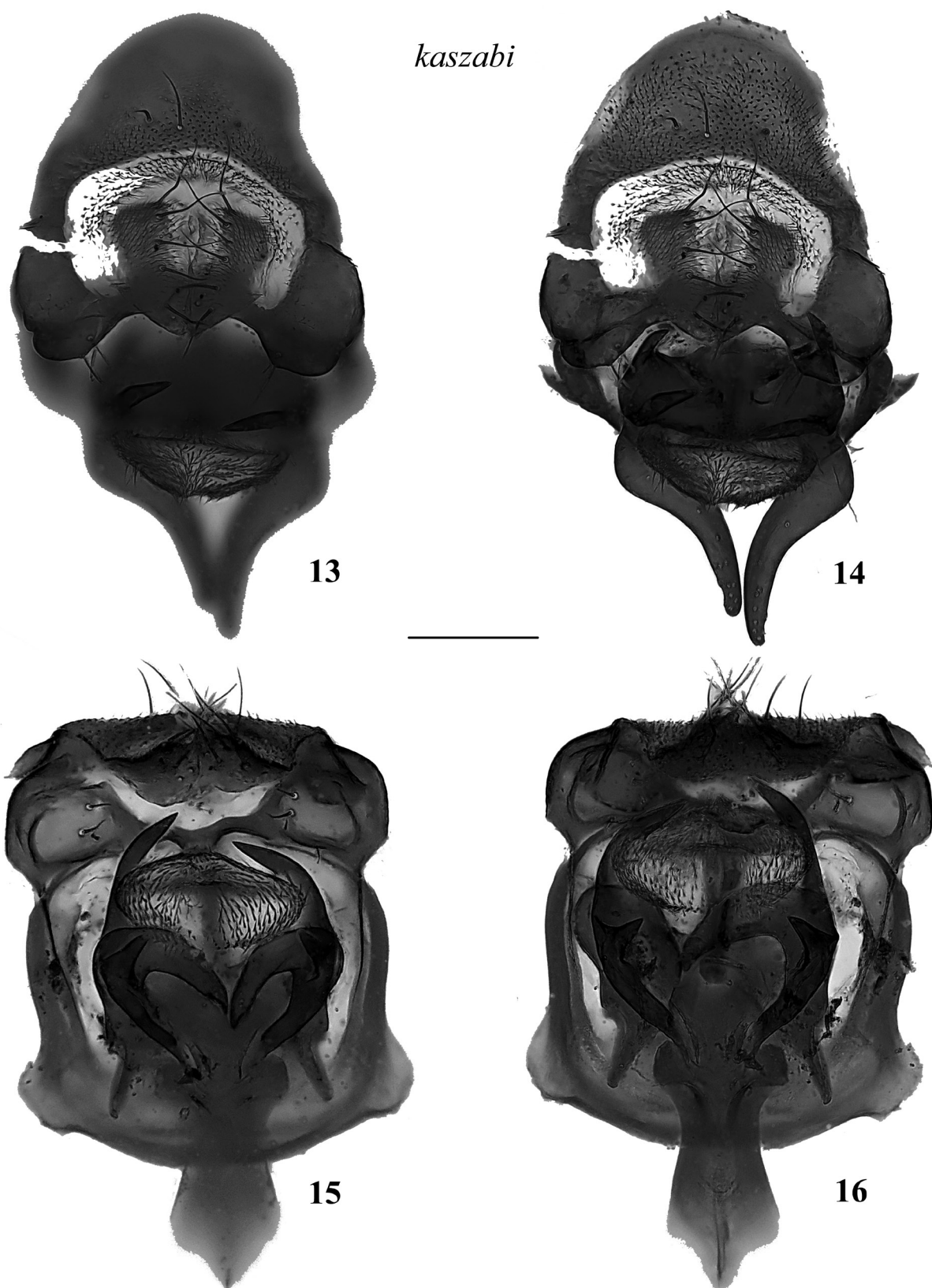
[triangle-shaped in *P. macai* sp. nov.] in dorsal and ventral views, microtrichose, and dorsally fused to the dorsoventrally flattened end of distal section of decasternum. Two pairs of paraphyses (Figs 19, 21, 22). Outer paraphysis laterally flattened and tube-shaped, subapically enlarged [triangle-shaped in *P. macai* sp. nov.], and turned ventrad in lateral view, with two parallel dorsal rows of ca. 4–5 outer setulae per row, articulated both with lateral inner margin (gonopods) of hypandrium medially, and with posterolateral region of aedeagal apodeme (Fig. 19). Inner paraphysis slightly shorter than outer paraphysis (Figs 11, 12), strongly sclerotized, bare, mediolaterally fused to aedeagal apodeme, tribranched (Figs 21a–c, 22a–c) [heptabranched in *P. macai* sp. nov.]: distal branch long, api-

cally sharp, slightly turned dorsad and inwards, submedi-odorsal branch wide, triangle-shaped, pointed laterad and dorsad, proximal branches somewhat rectangle-shaped, blunt, pointed dorsalwards and distally connected to each other by a membranous strip embracing submedian region of distal section of decasternum (Figs 10, 21). Aedeagal apodeme shorter than outer paraphysis (Fig. 19), dorsoventrally flattened, strongly sclerotized, laterally fused to anterior region of inner paraphysis (Fig. 21). Ventral rod apparently absent, probably turned backwards and fused to posteroventral region of aedeagal apodeme (Fig. 11).

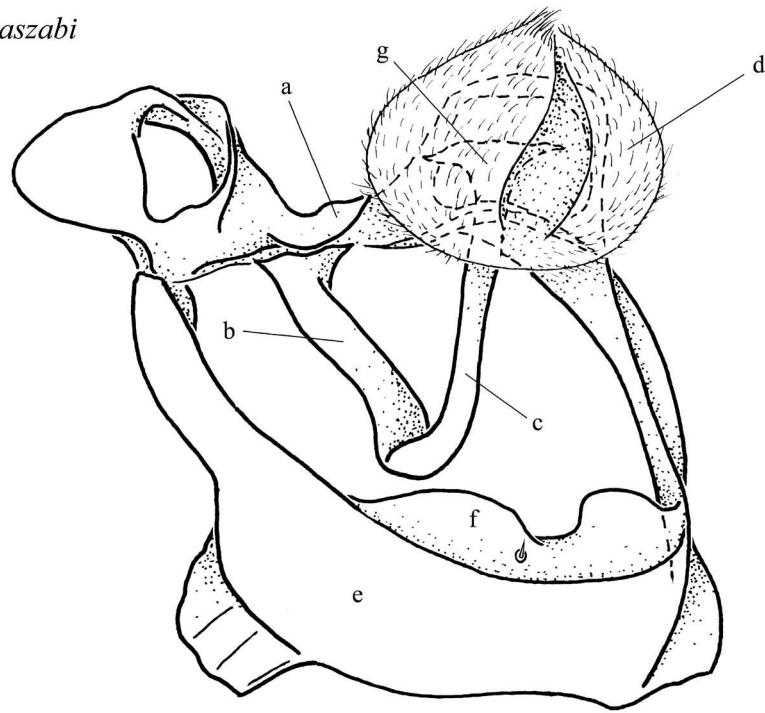
Distribution. Mongolia: Okada (1973): 271. Russia, Siberia: Toda and Vinokurov (1995): 189; Watabe et al. (1995): 199; Vinokurova (2003): 100.



Figures 10–12. *Paracacoxenus kaszabi* Okada, ♂ paratype, Central aimak, Ulan-Baator, Nucht im Bogdo ul, Mongolia (HNHM)
10 Terminalia, oblique dorsal view **11** Terminalia, left lateral view **12** Terminalia, oblique ventral view. Scale bar: 0.1 mm.

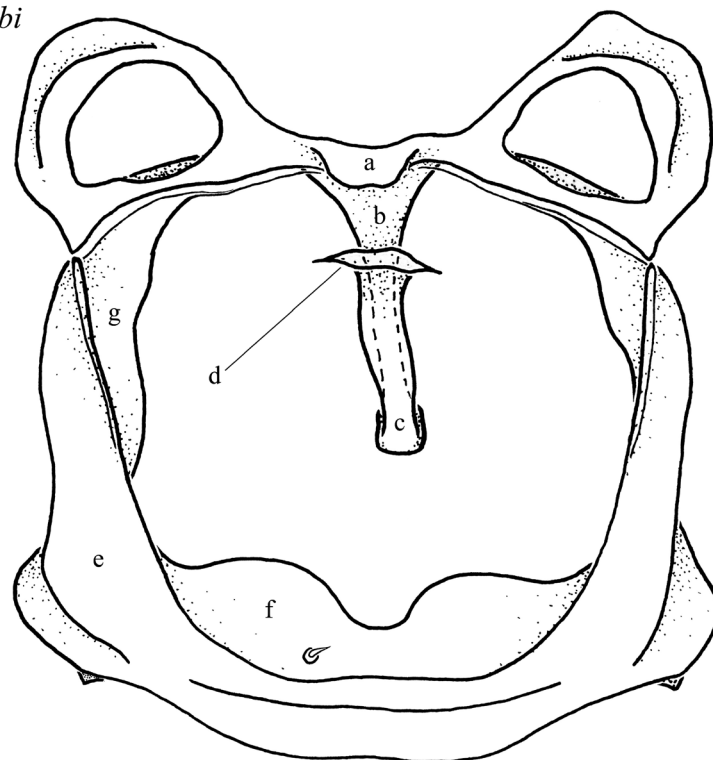


Figures 13–16. *Paracacoxenus kaszabi* Okada, ♂ paratype, Central aimak, Ulan-Baator, Nucht im Bogdo ul, Mongolia (HNHM)
13 Terminalia, dorsal view (in-focus: epandrium, cerci, tips of aedeagus and inner paraphyses) **14** Terminalia, dorsal view (in-focus: all sclerites) **15** Terminalia, posterior view **16** Terminalia, anterior view. Scale bar: 0.1 mm.

kaszabi

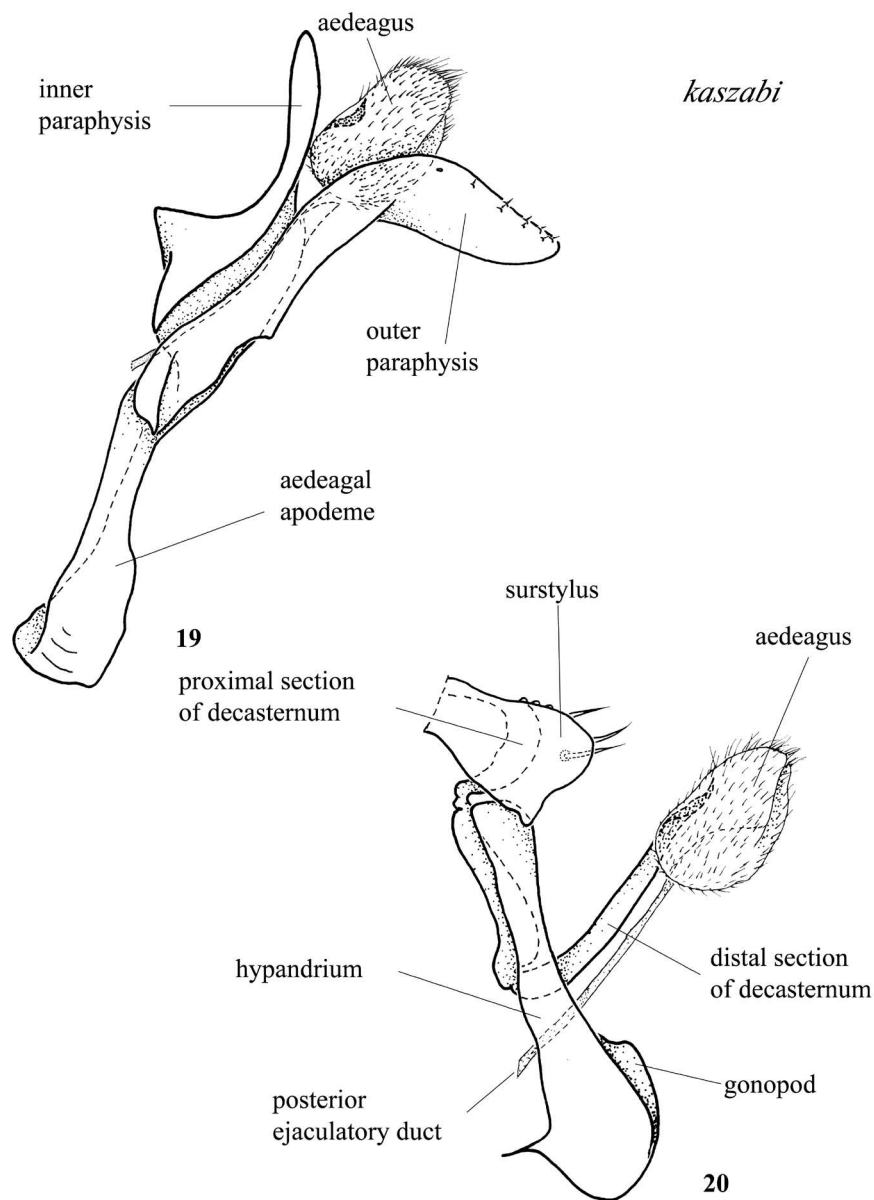
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Figure 17. *Paracacoxenus kaszabi* Okada, ♂ paratype, Central aimak, Ulan-Baator, Nucht im Bogdo ul, Mongolia (HNHM); decasternum, hypandrium + gonopods, aedeagus, oblique posterior view. Abbreviations: a = proximal section of decasternum; b and c = distal section of decasternum; d = membranous aedeagus; e = anterior region of hypandrium; f = fused gonopods; g = tip of distal section of decasternum (laterally expanded and fused to dorsal region of aedeagus). Scale bar: 0.1 mm.

kaszabi

18

Figure 18. *Paracacoxenus kaszabi* Okada, ♂ paratype, Central aimak, Ulan-Baator, Nucht im Bogdo ul, Mongolia (HNHM); decasternum and hypandrium + gonopods. Abbreviations: a = proximal section of decasternum; b and c = distal section of decasternum; d = tip of distal section of decasternum (laterally expanded); e = hypandrium left arm; f = anterior region of gonopods (fused to each other and to hypandrium); g = posterolateral region of left gonopod. Scale bar: 0.1 mm.



Figures 19, 20. *Paracacoxenus kaszabi* Okada, ♂ paratype, Central aimak, Ulan-Baator, Nucht im Bogdo ul, Mongolia (HNHM) **19** Aedeagal apodeme, left inner paraphysis, left outer paraphysis, membranous aedeagus and posterior ejaculatory duct, left lateral view **20** Left surstylus, decasternum, hypandrium, gonopod, aedeagus and posterior ejaculatory duct, lateral view. Scale bar: 0.1 mm.

***Paracacoxenus macai* sp. nov.**

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Figures 23–59

Cacoxenus kaszabi (Okada, 1973): Máca and Barták (2001: 431) [distribution; misidentification].

Paracacoxenus kaszabi Okada, 1973: Máca (1980: 33) [description; misidentification]; Laštovka & Máca (1987: 218) [distribution; misidentification].

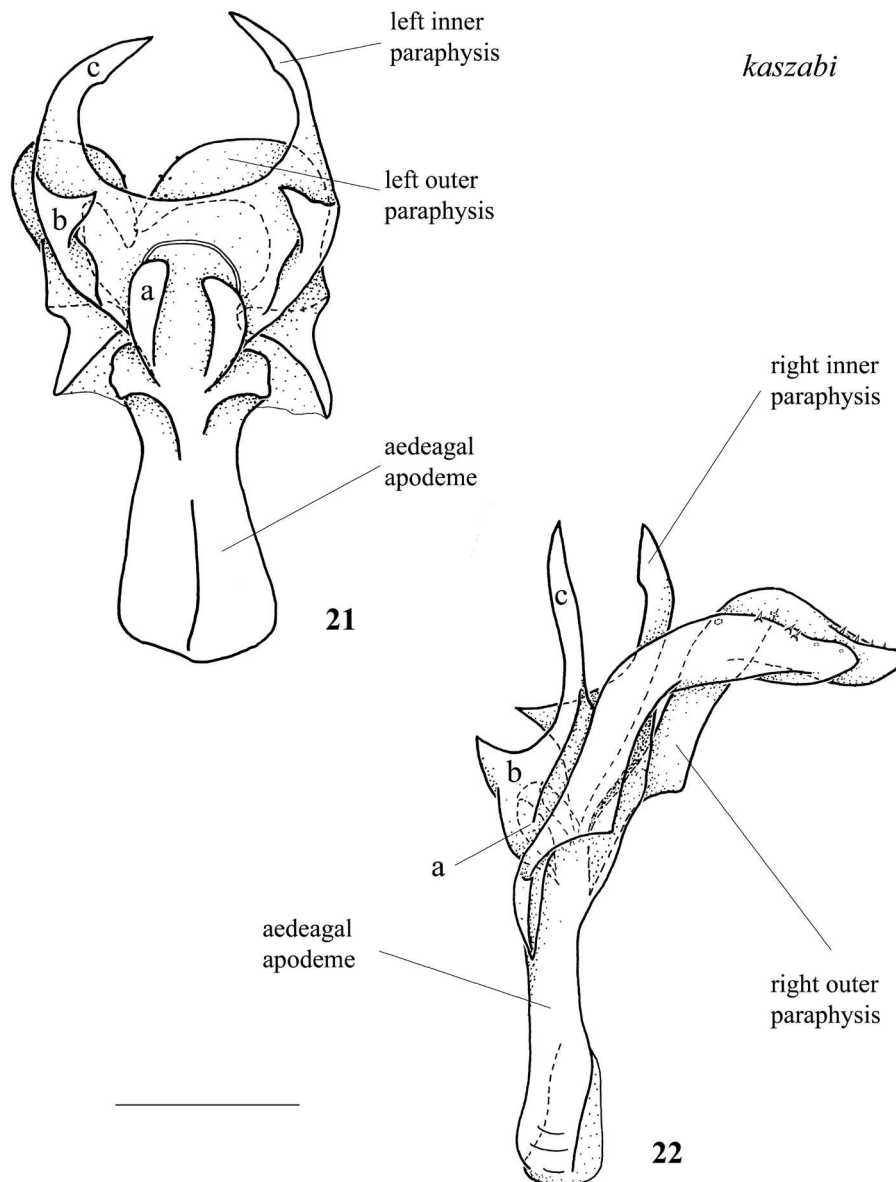
Cacoxenus (*Paracacoxenus*) *kaszabi* (Okada, 1973): Máca and Laštovka (1985: 282) [distribution; misidentification]; Máca and Laštovka (1986: 111) [distribution; misidentification]; Máca (1997: 86) [distribution; misidentification]; Máca (2009: 2) [distribution; misidentification].

Cacoxenus sp. nov. – Bächli (2008: 164) [distribution].

Paracacoxenus sp. aff. *kaszabi* sp. nov. – Bächli and Vilela (2011: 129) [description].

Type locality. ITALY: Region of Trentino-Alto Adige [South Tirol], Province of Bolzano, Parco Nazionale dello Stelvio, Schmelz [46°36'42"N, 10°34'36"E], 940 m.

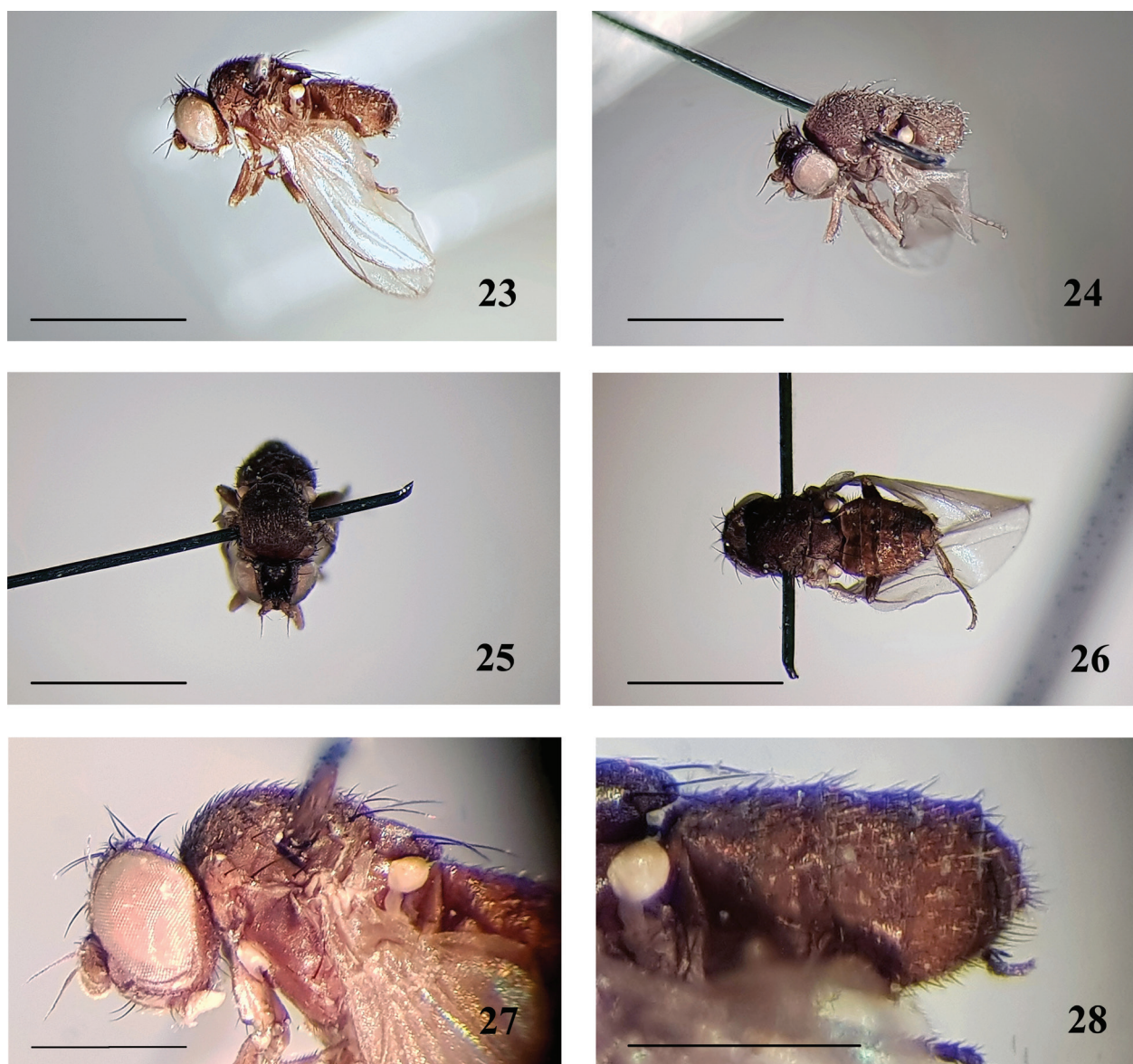
Type material. **Holotype**, ♂. ITALY: labelled “Schmelz 940 m 2 / 31.V.–11.VI.2005 / Lange & Ziegler leg. // ITALY: Trentino / Prov. Bolzano / P. N. [Parco Nazionale] dello Stelvio // ♂ // [abdomen in plastic tube filled with glycerin and attached to the pin] // HOLOTYPE [large red label] // terminalia / illustrated and / photographed // *Paracacoxenus* / sp. aff. *kaszabi* sp. nov. / Bächli & Vilela det. / 2007 // 700697 [ZMUZ code] // *Paracacoxenus* / *macai* sp. nov. / Bächli & Vilela det. 2017” (ZMB). **Paratypes**, 9 ♂♂ 3 ♀♀.



Figures 21, 22. *Paracacoxenus kaszabi* Okada, ♂ paratype, Central aimak, Ulan-Baator, Nucht im Bogdo ul, Mongolia (HNHM) **21** Three-branched inner paraphysis, outer paraphysis and aedeagal apodeme, anterior (dorsal) view **22** Three-branched inner paraphysis, outer paraphysis and aedeagal apodeme, oblique posterior view. Abbreviations: a = proximal branch; b = mediodorsal branch; c = distal branch. Scale bar: 0.1 mm.

ITALY: 1 ♂, labelled “Schmelz 940 m 2 / 31.V.–11.VI.2005 2 / Lange & Ziegler leg. // ITALY: Trentino / Prov. Bolzano / P. N. [Parco Nazionale] dello Stelvio // ♂ // PARATYPE [large red label] // *Paracacoxenus* / sp. aff. *kaszabi* sp. nov. / Bächli & Vilela det. / 2011 // 700698 [ZMUZ code] // *Paracacoxenus* / *macai* sp. nov. / Bächli & Vilela det. 2017” (ZMB). 2 ♂♂, labelled “Schmelz 940 m 4 / 27.VI.–4.VII.2005 4 / Lange & Ziegler leg. // ITALY: Trentino / Prov. Bolzano / P. N. [Parco Nazionale] dello Stelvio // ♂ // PARATYPE [large red label] // *Paracacoxenus* / sp. aff. *kaszabi* sp. nov. / Bächli & Vilela det. / 2011 // 700702 [resp. 700703, ZMUZ codes] // *Paracacoxenus* / *macai* sp. nov. / Bächli & Vilela det. 2017” (ZMB). [700703 was photomicrographed [Figs 23–28] in the present paper]. 1 ♂, labelled “Schmelz 940 m 5 / 4.–13.VII.2005 5 / Lange &

Ziegler leg. // ITALY: Trentino / Prov. Bolzano / P. N. [Parco Nazionale] dello Stelvio // ♂ // PARATYPE [large red label] // *Paracacoxenus* / sp. aff. *kaszabi* sp. nov. / Bächli & Vilela det. / 2011 // 700704 [ZMUZ code] // *Paracacoxenus* / *macai* sp. nov. / Bächli & Vilela det. 2017” (ZMB). 1 ♂, labelled “Schmelz 940 m 6 / 13.–25.VII.2005 6 / Lange & Ziegler leg. // ITALY: Trentino / Prov. Bolzano / P. N. [Parco Nazionale] dello Stelvio // ♂ // PARATYPE [large red label] // *Paracacoxenus* / sp. aff. *kaszabi* sp. nov. / Bächli & Vilela det. / 2011 // 700705 [ZMUZ code] // *Paracacoxenus* / *macai* sp. nov. / Bächli & Vilela det. 2017” (ZMB). 3 ♂♂, labelled “Schmelz 940 m 2 / 31.V.–11.VI.2005 2 / Lange & Ziegler leg. // ITALY: Trentino / Prov. Bolzano / P. N. [Parco Nazionale] dello Stelvio // ♂ // PARATYPE [large red label] // *Paracacoxenus* / sp. aff. *kaszabi* sp. nov. / Bäch-



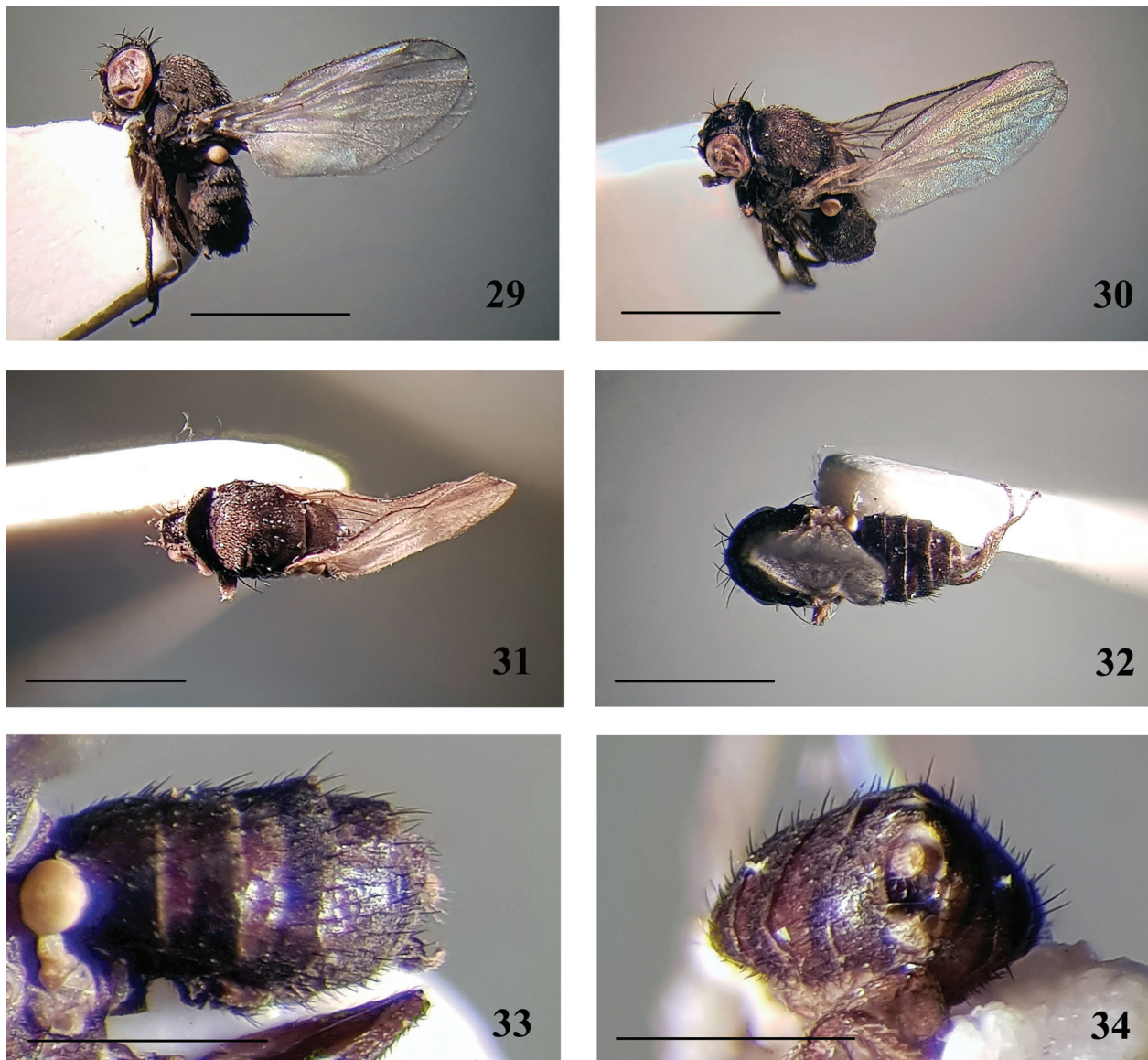
Figures 23–28. *Paracacoxenus macai* sp. nov., ♂ paratype # 277, Schmelz (940 m), Trentino, Bolzano, Parco Nazionale dello Stelvio, Italy, 24.VI.–4.VII.2005, Lange and Ziegler leg. (ZMB) **23** Habitus, left lateral view **24** Habitus, oblique dorsal view **25** Habitus, dorsal view **26** Abdomen, dorsal view **27** Head and thorax, close-up, left lateral view **28** Abdomen and terminalia close-up, left lateral view. Scale bars: 0.5 mm (**27, 28**); 1.0 mm (**23–26**).

li & Vilela det. / 2011 // 700699 [resp. 700700, 700701, ZMUZ codes] // *Paracacoxenus* / *macai* sp. nov. / Bächli & Vilela det. 2017” (ZMUZ). 1 ♂, labelled “Schmelz 940 m 7 / 25.VII.–1.VIII.2005 7 / Lange & Ziegler leg. // ITALY: Trentino / Prov. Bolzano / P. N. [Parco Nazionale] dello Stelvio // ♂ // PARATYPE [large red label] // *Paracacoxenus* / sp. aff. *kaszabi* sp. nov. / Bächli & Vilela det. / 2011 // 700706 [ZMUZ code] // *Paracacoxenus* / *macai* sp. nov. / Bächli & Vilela det. 2017” (ZMUZ). 1 ♀, labelled “Schmelz 940 m 1 / 21.–31.V.2005 1 / Lange & Ziegler leg. // ITALY: Trentino / Prov. Bolzano / P. N. [Parco Nazionale] dello Stelvio // ♀ // *Paracacoxenus* / sp. aff. *kaszabi* sp. nov. / Bächli & Vilela det. / 2011 // 700707 [ZMUZ code] // PARATYPE [large red label] // *Paracacoxenus* / *macai* sp. nov. / Bächli & Vilela det. 2017” (ZMB). 1 ♀, labelled

“Schmelz 940 m 8 / 1.–8.VIII.2005 / Lange & Ziegler leg. // ITALY: Trentino / Prov. Bolzano / P. N. [Parco Nazionale] dello Stelvio // ♀ // PARATYPE [large red label] // *Cacoxenus* / sp. aff. *kaszabi* sp. nov. / Bächli & Vilela det. / 2011 // 700708 [ZMUZ code] // *Paracacoxenus* / *macai* sp. nov. / Bächli & Vilela det. 2017” (ZMUZ). SWITZERLAND: 1 ♀, labelled “Helv. ZH 650 m / Zürich-Zürichberg [47°22'N, 8°34'E] / 12.V.1998 / leg. B. MERZ // ♀ // *Cacoxenus* / *exiguus* D. / G. Bächli det. // PARATYPE [large red label] // *Paracacoxenus* / sp. aff. *kaszabi* sp. nov. / Bächli & Vilela det. / 2007” (MHNG).

Additional paratypes: 22 ♂♂; see Bächli and Vilela 2011 (ZMB).

Other specimens examined: CZECH REPUBLIC: 1 ♂, labelled “Bohemia mer. / Soběslav-okolí [49°16'N,



Figures 29–34. *Paracacoxenus macai* sp. nov., ♂ non-type specimen, Bohemia mer., Soběslav-okolí, Czech Republic, 20.05.1999, J. Máca leg. (PCJM) **29** Habitus, left lateral view **30** Habitus, oblique dorsal view **31** Habitus, dorsal view **32** Abdomen, dorsal view: **33** Abdomen close-up, left lateral view [note partially extruded aedeagus and distal branch of inner paraphysis: compare with Bächli and Vilela (2011): p. 130, fig. 11A] **34** Terminalia close-up, posterior view. Scale bars: 0.5 mm (**33**, **34**); 1.0 mm (**29–32**).

14°43'E]/ Jan Máca lgt. / Brachov – 20.5.99 [handwritten] // *Paracacoxenus* / *macai* sp. nov. / Bächli & Vilela det. 2017 // ♂” (PCJM) [Figs 29–38]. 1 ♂, labelled “Bohemia mer. / Soběslav-okolí / Jan Máca lgt. / 17.6.75 Žišov [handwritten] // *Paracacoxenus* / *macai* sp. nov. / Bächli & Vilela det. 2017 // ♂” (PCJM) [Figs 39–48]. 1 ♂, labelled “Bohemia mer. / Soběslav-okolí / Jan Máca lgt. / 14 [17?].6.75 [handwritten] // ♂ *Paracacoxenus* [handwritten] // *Paracacoxenus* / *macai* sp. nov. / Bächli & Vilela det. 2017 // ♂” (PCJM) [Figs 49–59].

Diagnosis. See Bächli and Vilela (2011: 129) (under ‘*Paracacoxenus* sp. aff. *kaszabi* sp. nov.’). Analysis of some male terminalia sclerites is required to tell this species apart from *Paracacoxenus kaszabi*. They are as follows: cerci wide and setose (Bächli and Vilela 2011: 127 [Fig. 9A]), aedeagus triangle-shaped in dorsal and ventral

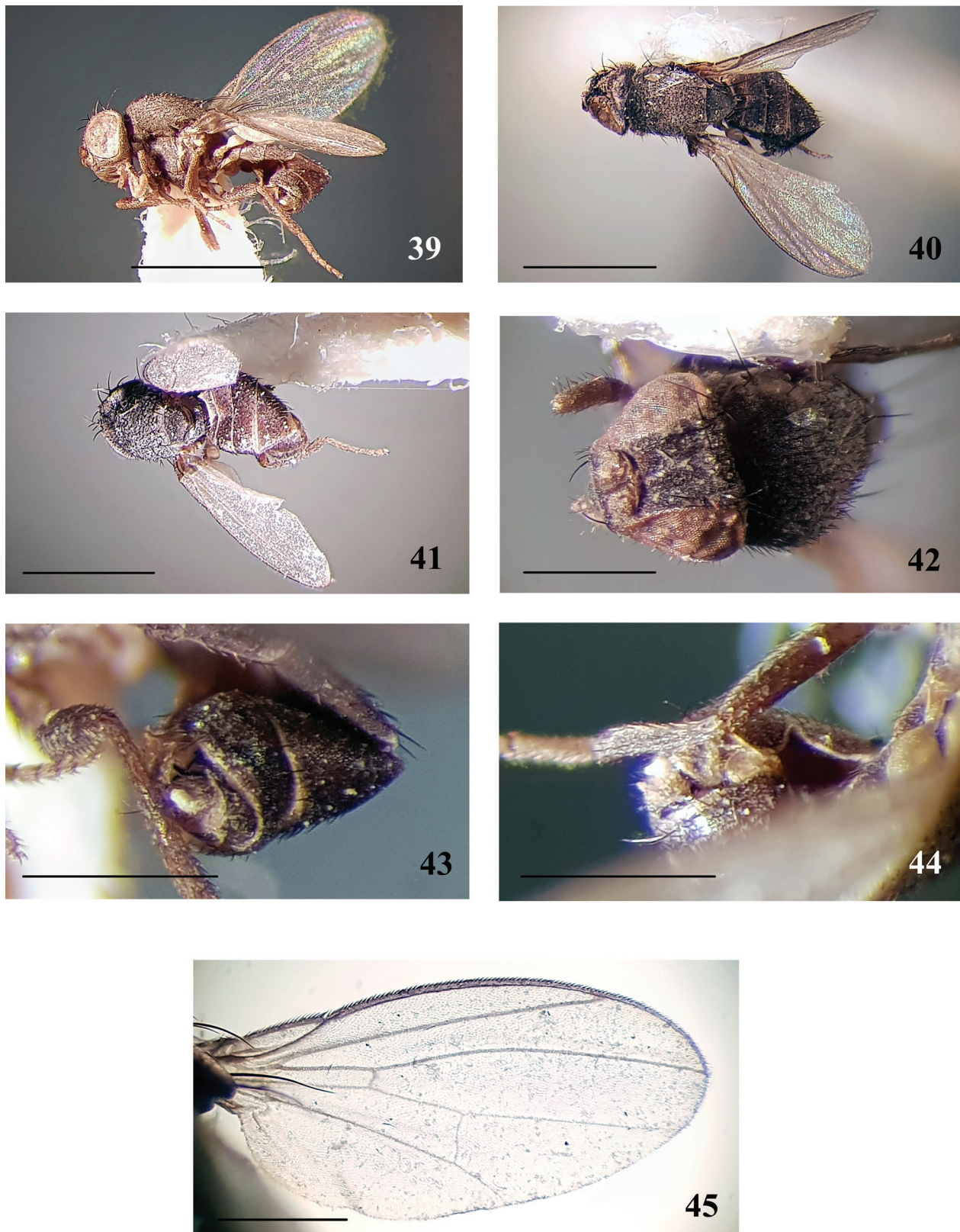
views (Bächli and Vilela 2011: 135 [Fig. 14E]), conspicuous heptabranched and strongly sclerotized inner paraphyses (Figs. 33, 37, 38, 48), and gonopods conspicuously warty (Bächli and Vilela 2011: 129 [Fig. 10A]).

Description and illustrations. See Bächli and Vilela (2011: 129) (under the name ‘*Paracacoxenus* sp. aff. *kaszabi* sp. nov.’).

Complementary redescription. The photomicrographs of the habitus of a male paratype (Figs 23–28) presented in this paper are intended to complement the original description of this species (Bächli and Vilela 2011). Three analysed male specimens from South Bohemia (PCJM) cited above were illustrated (Figs 29–59) for the purposes of geographical distribution only, as they represent new records, and they are not considered as belonging to the type series of *Paracacoxenus macai* sp. nov.



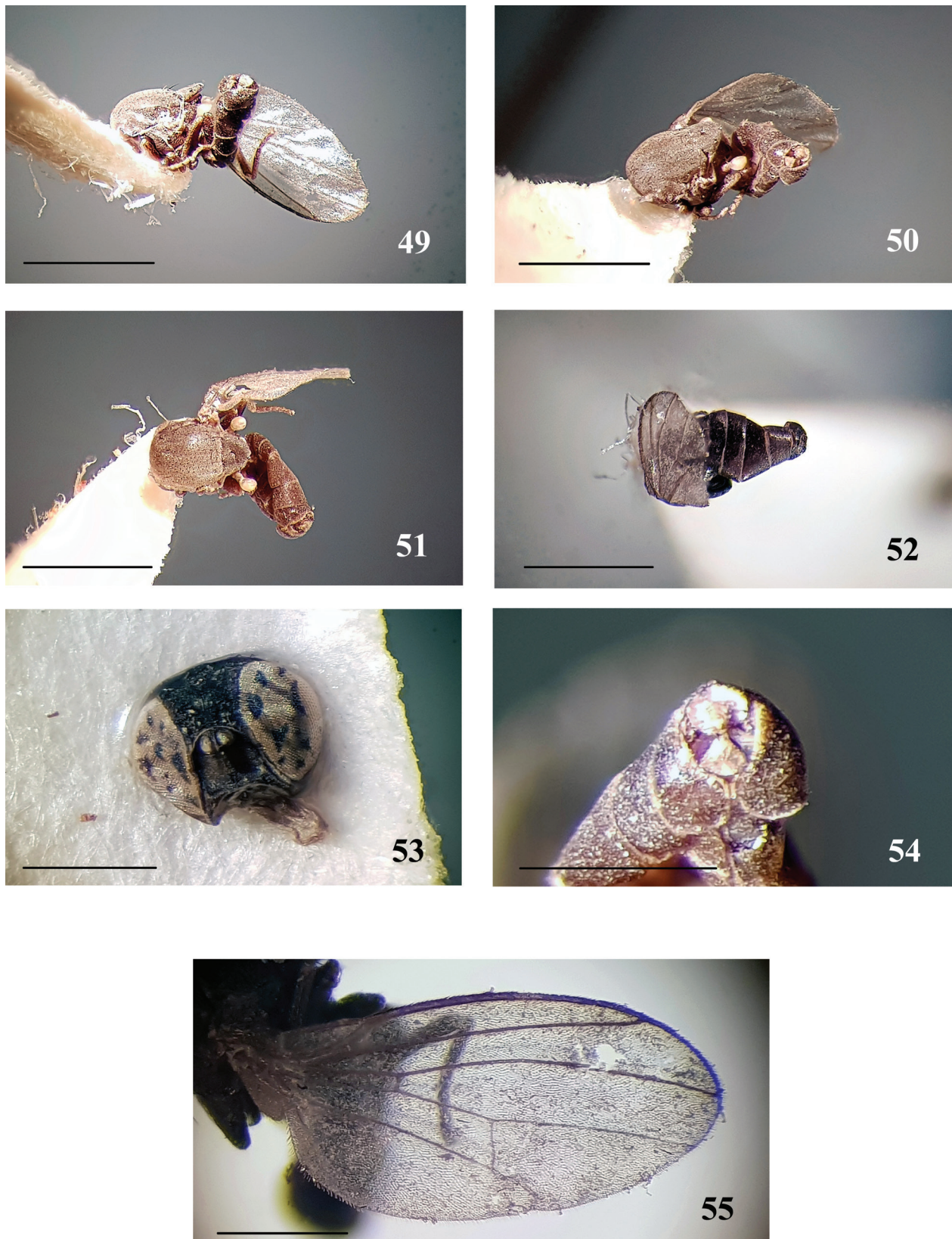
Figures 35–38. *Paracacoxenus macai* sp. nov., ♂ non-type specimen, Bohemia mer., Soběslav-okolí, Czech Republic, 20.05.1999, J. Máca leg. (PCJM) **35** Terminalia, left lateral view (in-focus: all sclerites, including ejaculatory apodeme) **36** Terminalia, dorsal view (in-focus: epandrium, surstyli, cerci and ejaculatory apodeme [lateral view]) **37** Terminalia, dorsal view (in focus: aedeagus, distal section of decasternum, inner paraphyses, aedeagal apodeme and ejaculatory apodeme [lateral view]) **38** Terminalia, dorsal view (in focus: outer paraphyses, anterior regions of hypandrium and of inner paraphyses). Scale bar: 0.1 mm.



Figures 39–45. *Paracacoxenus macai* sp. nov., ♂ non-type specimen, Bohemia mer., Soběslav-okolí, Czech Republic, 17.06.1975, J. Máca leg. (PCJM) **39** Habitus, left lateral view **40** Habitus, dorsal view **41** Habitus, dorsal view **42** Head close-up, dorsal view: **43** Terminalia close-up, oblique posterior view **44** Terminalia close-up, posterior view [note membranous, triangle-shaped aedeagus] **45** Right wing, dorsal view. Scale bars: 0.5 mm (**42–45**); 1.0 mm (**39–41**).



Figures 46–48. *Paracacoxenus macai* sp. nov., ♂ non-type specimen, Bohemia mer., Soběslav-okolí, Czech Republic, 17.06.1975, J. Máca leg. (PCJM) **46** Terminalia (including syntergite 6 + 7), left lateral view (in focus: all sclerites) **47** Terminalia, dorsal view (in focus: epandrium, cerci, syntergite 6 + 7, hypandrium, paraphyses [partially] and aedeagal apodeme) **48** Terminalia, dorsal view (in focus: hypandrium, inner paraphyses and median region of outer paraphyses). Scale bar: 0.1 mm.



Figures 49–55. *Paracacoxenus macai* sp. nov., ♂ non-type specimen, Bohemia mer., Soběslav- okolí, Czech Republic, 17.06.1975, J. Máca leg. (PCJM) (left wing missing, head glued on the cardboard triangle) **49** Habitus, left lateral view (abdomen turned upwards) **50** Habitus, oblique dorsal view **51** Habitus, dorsal view **52** Abdomen, dorsal view: **53** Head close-up, anterior view **54** Terminalia close-up, posterior view [note membranous, triangle-shaped aedeagus] **55** Right wing, dorsal view. Scale bars: 0.5 mm (53–55); 1.0 mm (49–52).



Figures 56–59. *Paracacoxenus macai* sp. nov., ♂ non-type specimen, Bohemia mer. Soběslav-okolí, Czech Republic, 17.06.1975, J. Máca leg. (PCJM) **56** Terminalia, left lateral view (in focus: all sclerites) **57** Terminalia, dorsal view (in focus: epandrium, cerci, hypandrium, paraphyses and aedeagal apodeme) **58** Syntergite 6 + 7, right lateral view **59** Syntergite 6 + 7, posterior view. Scale bars: 0.1 mm.

Etymology. Epithet: a genitive patronym to honour of our colleague Dr Jan Máca who first detected this species in Europe (Czech Republic).

Distribution. Italy: Bächli and Vilela (2011: 131). Switzerland: Bächli and Vilela (2011: 131). Czech Republic (misidentified as *P. kaszabi*): Máca (1980: 331): Veselí nad Lužnicí (South Bohemia); Máca and Barták (2001: 438): Bílina, Duchcov (northwestern Bohemia). Slovakia (localities not mentioned) (misidentified as *P. kaszabi*): Máca and Laštovka (1985: 270); Máca and Laštovka (1986: 111); Laštovka and Máca (1987: 218); Máca (1997: 96).

Paracacoxenus argyreator (Frey, 1932)

Figs 60–65

Cacoxenus argyreator Frey: Frey (1932: 84) [description]; Bächli & Rocha Pité (1982: 310) [distribution].

Paracacoxenus argyreator (Frey): McAlpine (1968: 524) [proposed comb. nov.].

Cacoxenus (*Paracacoxenus*) *argyreator* Frey: Máca et al. (2015) [distribution].

Type locality. Finland, Uusimaa: Tvärminne, Zoological Station [59°31'N, 23°12'E].

Material examined. SLOVAKIA: 1 ♂, labelled “Slovakia centr.: Pofana / B. R. Spády valley / 48°42'N, 19°31'E / J. Roháček leg. // car net / 18.6.2009 // *Cacoxenus* (*P.*) *argyreator* Frey [handwritten] / ♂ / J. Roháček det. 2009” [specimen completely mouldy] [PCJM].

Complementary description (Figs 60–65). A mouldy male of *Paracacoxenus argyreator* (Frey) from Czech Republic received from Jan Máca together with the three specimen misidentified by him as *P. kaszabi* (cited above) shows, beside the silvery looking mesonotum (Figs 60–62, 64), a remarkable preapical seta on the tibia of middle leg (McAlpine 1968: 526) which is unique in known Drosophilidae species (Figs 60, 61, 65). The female lacks both these characters.

Key to European species of *Cacoxenus* Loew and *Paracacoxenus* Hardy [modified from Bächli et al. (2004)]

- 1 Larger flies, body length more than 3 mm. 14–20 irregular rows of acrostichal setulae. Scutum unicolourous blackish-brown, grayish microtrichose, without darker spots. All tibiae without preapical seta. Mesocoxa with 2 strong setae, besides a few smaller ones. Metatarsomere 1 in male with a brush-like structure beneath, broad and swollen. Aedeagus absent. One species: *C. indagator* Loew (widespread in North, Central and Southern Europe)..... **Genus *Cacoxenus* Loew**
- Smaller flies, body length less than 3 mm. 8–10 rows of acrostichal setulae. Scutum with or without darker spots. At least mesotibia with a (sometimes short) preapical seta. Mesocoxa with several setae of nearly equal size. Metatarsomere 1 normal. Aedeagus present. **Genus *Paracacoxenus* Hardy** 2
- 2(1) Frons blackish-brown, grayish microtrichose. Male: mesotibia with a distinctly prolonged preapical seta (Figs 60, 61, 65). Syntergite 6 + 7 ventrally with a claw-like extension (Bächli et al. 2004: 53 [fig 117])..... ***P. argyreator* (Frey)**
- Frons, except orbital plates, velvety black. Syntergite 6 + 7 ventrally devoid of a claw-like extension (Fig. 59). 3
- 3(2) Frons rather narrow (index about 1.6). Distance between proclinate to upper reclinate orbitals about twice that of upper proclinate orbital to inner vertical (Fig. 7). Terminalia see Bächli and Vilela (2011: 12, [fig. 14E]) conspicuously bearing heptabranched inner paraphyses, warty gonopods and dorsally triangle-shaped aedeagus (Northern Italy, Switzerland, Czech Republic [Bohemia] and Slovakia)..... ***P. macai* sp. nov.**
- Frons rather broad (index about 1.2). Distance between proclinate to upper reclinate orbitals usually more than twice that of upper proclinate orbital to inner vertical. Terminalia see Bächli and Vilela (2011: 3, [fig. 14A–D]) bearing tri-branched inner paraphyses, smooth gonopods and inverted drop-shaped aedeagus (as seen from dorsal view) (Central Europe)..... ***P. exiguus* (Duda)**

Discussion

Species of *Cacoxenus* and *Paracacoxenus* do not show a particular Alpine distribution (Máca 1977, Máca et al. 2015). However, almost all specimens of *Paracacoxenus macai* n. sp. were collected in Schmelz (South Tyrol), using a Malaise trap. The biology of *Paracacoxenus* species is virtually unknown, but a connection with stem rust is suggested (McAlpine 1968) and the Schmelz locality is covered with many broad-leave trees (Ziegler 2008). We suppose that there are additional such localities in the Alps where *Paracacoxenus macai* be abundant.

Conclusion

The identity of *Paracacoxenus kaszabi* was clarified through the analyses of the male terminalia of a paratype from Mongolia. The previous suspicion that similar specimens collected both in Italy and Czech Republic do not belong to this species was confirmed. However, we were not able to check all specimens previously identified as *P. kaszabi* that have been recorded from Europe. Given that *P. kaszabi* and *P. macai* sp. nov. are sibling species, fully differentiated only by the male terminalia, we suggest that all western Palaearctic specimens previously identi-



Figures 60–65. *Paracacoxenus argyreator* (Frey), ♂ mouldy non-type specimen, Pol'ana B. R. Spádi valley, Slovakia centr. [central], 18.6.2009, J. Roháček leg. (PCJM) **60** Habitus, left lateral view **61** Habitus, oblique dorsal view [note mesotibia bearing a long preapical seta] **62** Habitus, dorsal view **63** Abdomen, dorsal view: **64** Head close-up, dorsal view **65** mesotibia bearing a remarkable long preapical seta, close-up. Scale bars: 0.5 mm (**64**, **65**); 1.0 mm (**60–63**).

fied as the former species belong to *P. macai* sp. nov., and that *P. kaszabi* is most probably a species of central and eastern Asian distribution.

Acknowledgements

We want to thank Dr. Zoltán Soltész, Budapest (Hungary), and Dr. Jan Máca, Veselí nad Lužnicí (Czech Republic), for making available the specimens studied. We are also indebted to Wayne N. Mathis, Washington DC (USA), for checking the English text. The manuscript was improved by hints of Masanori J. Toda and Severin Korneyev.

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